

REMARKS

Claims 1-16, and 19-27 are pending in the present Application. Claim 19 has been canceled, Claims 1, 2, and 20 have been amended, and Claims 4, 6, 10-12, 14, 15, and 21-27 are withdrawn, leaving Claims 1-3, 5, 7-9, 13, 16, and 20 for consideration upon entry of the present Amendment.

Claim 1 has been amended to include the phrase “to create a concentration gradient of one or more dopant or substituent element(s) from the surface to the bulk” from Claim 2, and to include the limitations of Claim 19. Support for the amendments can therefore be found in Claims 2 and 19. Accordingly, Claim 2 has been amended to remove that portion used in Claim 1, and Claim 19 has been canceled herewith.

Claim 20 has been amended to correctly depend from Claim 1.

Claims 21, 23, 24, and 26, though withdrawn, have also been amended to correctly depend from Claim 1.

The text of Claim 17, previously canceled but inadvertently included, has been removed.

No new matter has been introduced by these amendments. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 19-20 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner has noted that the claims depend from canceled claim 18. Accordingly, claim 20 has been amended as described hereinabove to correctly depend from claim 1. Claim 19, which has been canceled upon entry of the present amendment, has not been amended because the rejection of this claim is now moot. Accordingly, claim 20 should now correctly depend from claim 1.

The Examiner further notes that claims 21-27 also depend from claim 18. Accordingly, claims 21, 23, 24, and 26 have been amended as described hereinabove to

correctly depend from claim 1. Withdrawal of any potential rejection of these claims is also therefore respectfully requested.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-3, 5, 7-9, 13, 17, 17, and 20 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent Application Publication No. 2002/0114993 ("Miyaki") in view of U.S. Patent No. 5,916,485 ("Besenhard"). Applicants respectfully traverse this rejection.

Miyaki discloses a method for producing a lithium ion secondary battery having a Li-based cathode. Abstract. A protective layer such as an electrically conducting protective layer can be included on the cathode layer. Abstract, p. 2, ¶¶ [0022]-[0027]. Successive coating of the layers is disclosed. p. 4, ¶ [0059].

Besenhard discloses a substrate-induced coagulation process and a highly conducting composition prepared by implanting very small amounts of conductive material during the substrate induced coagulation process. Col. 2, lines 7-11 and 27-34. Besenhard discloses that substrate induced coagulation can provide adsorption of dispersed particles on a substrate surface and local coagulation exclusively at the substrate surface. Col 3, lines 5-8. Conductive composites prepared according to Besenhard, such as battery electrodes, are made with the smallest possible amounts of conductive additions, since these interfere with the desired characteristics of the non-conductive substrate material. Col. 3, lines 13-21. Highly conductive composites are produced from nonconducting or poorly conducting particles covered with a coating of highly disperse conducting solids by substrate-induced coagulation. Col. 3, lines 31-35.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a *prima facie* case of obviousness, i.e., that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art had a reasonable expectation of success,

determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996).

Instant claim 1 describes modifying a substrate-induced coagulation (SIC) process by combining it with heat treatment. The bulk of material to be surface modified, as claimed in the amended claim 1, includes LiCoO_2 , LiNiO_2 , $\text{LiNi}_x\text{Co}_{1-x}\text{O}_2$, LiMn_2O_4 , LiFePO_4 , and materials derived therefrom by doping or substitution with other elements. As a result of heat treatment, a surface modified material having an inner core (bulk) and an outer shell (surface) with a stoichiometric concentration gradient of one or more dopant or substituted elements from the surface to the bulk can thereby be obtained. This provides a surface-modified cathode material for lithium-based batteries with stoichiometric concentration gradient, as a result of heat treatment of the bulk material so treated.

Miyaki discloses formation of a positive electrode active material by calcining a lithium compound mixed with a transition metal compound, and that lithium is intercalated into the transition metal oxide. p. 10, ¶¶ [0429] and [0431]. However, Miyaki is silent as to calcining of treating a bulk lithium oxide-based material (i.e., the core material), with a flocculant, adsorbing solid particles thereon, and subsequently treating the flocculant-bulk material combination with heat to provide a material with a stoichiometric gradient extending from surface to bulk, as described in the instant claims. Miyaki discloses a secondary battery having an electrode with protective layer thereon, and discloses that the protective layer can be formed successively or simultaneously by applying an electrode material mixture onto a current collector. p. 4, ¶¶ [0058] and [0059]. However, Miyaki is silent as to and does not disclose a method of treating a bulk lithium oxide-based material (i.e., the core material), with a flocculant, adsorbing solid particles thereon, and subsequently treating the flocculant-bulk material combination with heat to provide a material with a stoichiometric gradient extending from surface to bulk, as described in the instant claims.

The Examiner indicates that Miyaki teaches hot air drying at elevated temperature. p. 3, ¶ [0460]. However, hot air drying in Miyaki is disclosed to remove water from the layer

in order to maintain water content below a predetermined level (less than 500 ppm). Further, the hot air drying of Miyaki is 80 to 350°C. p. 13, ¶ [0460]. One skilled in the art will appreciate that the hot air drying of Miyaki would be insufficient in temperature to provide the stoichiometric gradient as discussed in the instant specification as filed on e.g., p. 7, line 12 to p. 8, line 2, which requires temperatures of greater than 550°C to remove a flocculant such as gelatine. Finally, no disclosure is made in Miyaki of the formation of a stoichiometric gradient in the bulk of material with formation of an insulating layer. Therefore, hot air drying as disclosed in Miyaki differs from heat treatment of the instant claims which provides a concentration gradient of the dopant or element forms from the surface to the bulk.

Besenhard does not disclose a method for producing a surface-modified cathode material, nor a surface modified material that can be used as a cathode material for lithium batteries, as claimed in amended claim 1. Though Besenhard discloses that the process can be applied to a battery electrode, it does not disclose a method for producing a surface-modified cathode material by treating lithium oxide based bulk material with a flocculant, adsorbing solid particles thereon, and subsequently treating with heat.

Specifically, Besenhard does not disclose modifying a lithium oxide based bulk material nor does Besenhard disclose heat treatment thereof. Accordingly, the concentration gradient of dopant or substitute element caused by the heat treatment and as claimed in claim 1 is not disclosed.

Since both Miyaki and Besenhard, either alone or in combination, fail to disclose all elements of the instant claims, specifically that of heat treatment of a bulk material treated with a flocculant, adsorbing dopants or substituted elements thereto, and formation of a stoichiometric gradient from the surface to the bulk by heat treatment, each therefore fails to remedy the deficiencies of the other. There is thus no teaching or suggestion that would induce one skilled in the art to modify Miyaki with Besenhard to achieve the desired outcome, i.e., the formation of a stoichiometric gradient of dopant or substituted elements, that would extend from the surface to the bulk material. Further, there is no reasonable expectation provided in either the method of Miyaki, which provides a calcined material with a protective overcoat, modified with the substrate induced coagulation process of Besenhard which is

disclosed to provide a highly disperse dopant in the conductive material, would provide a surface modified material having the disclosed stoichiometric gradient of dopant or added element from the surface to the bulk.

Thus, the method according to the instant claims is not obvious from those of the Miyaki in view of Besenhard. Thus, Miyaki in view of Besenhard fails to disclose all elements of the instant claims, and therefore does not make the instant claims unpatentable. Withdrawal of the rejection and allowance of the claims is therefore respectfully requested.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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